Казанский национальный исследовательский

**КАИ**

технический университет им. А.Н. Туполева

**KAZAN NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER A. N. TUPOLEV - KAI**

# International conference
## «ICNR-2018»



**Nigmatullin R.Sh.**
(5.01.1923-7.07.1991)

**9-12 October 2018
Kazan**



## The first information message about the organization of the International conference "Nigmatullin's Readings-2018"

We invite the teachers, scientific researchers specialists of enterprises and all interested persons to participate in the International conference "**The Nigmatullin's Readings-2018 (ICNR-2018)**", which will be organized in the period 9-12 October of 2018 year in Kazan city (Russian Federation).

The conference is devoted to the 95-th anniversary of the outstanding scientist, the founder of the Kazan School of molecular electronics and application of the fractional operators in radioelectronics, the rector of the KAI, (1967–1977), the Chairman of the Supreme Council of the TASSR Nigmatullin Rashid Shakirovich.

*Taking into account the large contribution of the Prof. R. Sh. Nigmatullin in modeling, physical and technical realization of the fractional operators, the Organization committee of the FDA - 16 accepted the decision to attach to the NR-2018 the international status as the section of the International conference ICFDA'18 (Amman (Jordan), July 2018). The local president of the Tatarstan republic supported this solution. Based on this solution the ICNR-2018 increases its traditional frame including the actual problems related to analysis and synthesis of fractal elements, device and systems, the treatment methods of the fractal signals and their applications in modern science and technics.*

More specifically, in the frame of the ICNR-2018 the following actual problems are planned to be discussed:

Telecommunication systems; the methods of electronic countermeasures; molecular electronics, electrochemical systems, technical electrodynamics; photonics and optical signals treatment methods; dynamical chaos, quantum signals and quantum communications, application of the fractals in technics and educations etc. These directions are included in the following sections.

*The conference sections*:
**1.Fractal elements and devices: analysis, synthesis and realizations.**

**2. Fractal systems: analysis, synthesis and applications.**

**3. The statistical methods of the treatment of the fractal signals and their applications.**

**4. Molecular electronics, electrochemical systems, devices and sensors.**

**5. Radioelectronics and telecommunication systems, noise immunity, electronic countermeasures.**

**6. Technical electrodynamics, antennas technics and microwave technologies.**

**7. Photonics and optical signals treatment.**

**8. Dynamical chaos and physical fractals.**

**9. Nanoelectronics and nanomaterials.**

**10. The lasers and additive technologies.**

**11. Quantum signals processing and quantum communications.**

**12. Fractal paradigm in engineering education.**

**Nigmatullin Rashid** was outstanding soviet scientist in the region of radioelectronics, creator of the scientific school, organizer of the high education and the public figure. He was the doctor of the mathematics and physics (1965), full professor (1967), honored worker of science and technics of the Russian Federation (1971). He was born in Kazan. Then the service in the Soviet Army (1941-1945), the participant of the Great Patriotic War The graduator of the Kazan State University (KSU), the postgraduate student of the KSU (1950-1953), the Candidate of the Physics and Mathematics Sciences (1953), the reader (1953). Starting from 1953 year, he was invited to the KAI: the head of department of the theoretical radio-techniques and electronics (1954-1988), the rector of КАИ КАИ (1967-1977), full professor of the department (1988-1991). The chairman of the Supreme Council of the TASSR (1971-1980). He was decorated by the Lenin's Order, of the Labor Red Banner, the Honored golden and silver barges and medals of the All Union Exhibition of the USSR.

The scientific activity of the R. Sh. Nigmatullin was concentrated in the laboratories of the Radioelectronics and Informative-Measurement Technics department of the KNRTU-KAI and started from 1953 year from the moments of the creation of this department in KAI.

In the first time, the R. Sh. Nigmatullin was realized the operations of the fractional differentiation and integration in the beginning of the 60-s of the last century. For realization of this idea he used electrochemical elements, later he developed the methods of the synthesis of these element using the poly-chain RLC elements that enabled to realize these specific operations in real devices.

In the frame of his scientific school, there were developed mathematical and radioelectronics applications of the fractional operators in the different branches of science and techniques. Under his direct supervision the joint (together with the RAS) the research laboratory corresponding to this direction of the research was created (1974-1991).

The scientists of the Nigmatullin's school published more 900 papers, received 160 patents and authorship certificates, they suggested for industry more than 240 original devices.

Now the School has wide scientific connections with scientific structures of Russia and abroad. In particular, with the leading scientists and organizations from France, China, Germany, Italy, Bulgaria and Serbia.

**Rashid Sh. Nigmatullin** was born in 1923 in Kazan, Russia Federation (then Soviet Union). He was the Rector (1967-1977) of the Kazan Aviation Institute, and it was during his tenure that it was adopted, in 1973, the name of Andrey Nikolayevich Tupolev, a famous Russian aircraft designer (who had died in the year before). Then KAI received the official name called Kazan National Research Technical University named after A.N. Tupolev-KAI (KNRTU-KAI). As a publicly active man he was also Chairman (1971-1980) of the Supreme Council of the Tatarstan Autonomous Soviet Socialist Republic (TASSR). For many years he was the head of the Theory of RadioEngineering and Electronics Department (1954-1988) and had many pupils and followers (including his son Raoul, 40 Dr.Sc., 25 Ph.D., etc.). They contributed to further development of the science and its applications in the related areas. Rashid Nigmatullin died in 1991, leaving a great number of scientific ideas and projects unfinished. In November 2013, KNRTU - KAI organized the International Scientific and Technical Conference called "Nigmatullin's Readings" - a traditional event, this time dedicated to the 90th anniversary of birthday of Prof. R. Sh. Nigmatullin. See details in the Editorial Note in this journal. The basic directions of his scientific activity were: molecular electronics, analysis and synthesis of electric circuits, mathematical and electric modelling of the charge transmission on the interphase boundary electrode/electrolyte. He was working and creating new trends in the fields of radio-engineering, radioelectronics, electrochemistry and other related applicable sciences. Yet in the 1950s Prof. Nigmatullin introduced new concepts and ideas to build miniature electronic devices and detectors by using the properties of the systems at the boundary electrode/fluid, and established that in these models the fractional differential and integration operations are realized. As an electrical analogue of diffusion resistance, he suggested a semi-infinite resistor-capacity RC-cable, in which the process of distribution of the potential is similar to the diffusion process. Nigmatullin established that the input impedance of the system electrode/electrolyte is proportional to $p^{-1/2}$, where p is the Laplace operator. This was a technical realization of the mathematical operations of fractional order (semi-order) integro-differentiation, that can be found in his papers published in 1964 year. He proposed a polarography method for construction of fractional-differentiated polarograms; this innovation helped to find, with enough speed and accuracy (1-2%), the form of the desired polarogram after a fractional differentiation. Another proposal that became very useful in the FC applications came from analysis of the integral equation given by Nigmatullin to relate the surface concentration and the density of the substance flow through the electrode. He showed that differentiating by d/dt1/2 the time variance of the surface concentration C(0,t) it is possible to find directly the gradient of concentration or density, thus avoiding to solve the boundary value problem for the diffusion equation. This property became the base of electrical modelling of cells. In the mid-1980s, FC was related with the so-called constant phase elements (CPE) and also with the objects of the fractal geometry, thus finding new horizons for applications. Nigmatullin expected that the close relationship exists, since any arbitrary mathematical operation has, at its physical realization, a definite geometry or topology. He thought about the representation of the diffusion impedance operator via a cascade-model of involved RC-elements. These RC elements should have a self-similar structure to be copied on the different scales. These ideas and relationships including the complex parts of the non-integer integrals and derivatives were developed and mathematically proved later by his son Prof. Raoul R. Nigmatullin.

*HISTORICAL SURVEY SOME PIONEERS OF THE APPLICATIONS OF FRACTIONAL CALCULUS*

Duarte Valerio, Jose Tenreiro Machado, Virginia Kiryakova //Fractional Calculus &Applied Analysis., V17, N2, 2014